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Serious response during tilt-table test in elderly and its prophylactic management

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Abstract: Objective: To evaluate the serious response during tilt-table test (TTT) and its prophylactic management. Method: Seventy-six elderly patients were tested at a tilt angle of 70 degrees for a maximum of 45 min and then subjected to isoproterenol-provocative tilt testing. ECG and blood pressure were monitored during the test and patients were kept at normal saline condition through a peripheral intravenous duct. Results: Fifty-one of 76 patients were defined as positive including 23 having serious response; 6 of the 23 patients had arteriosclerosis involving internal carotid arteries and 7 cases had bradycardia, two of which were associated with II°-I A-V block and the others with chronic atrial fibrillation. The serious response consisted of cardiac arrest for more than 5 s (6 cases), or serious bradycardia for more than 1 min (7 cases) or serious hypotension for more than 1 min (10 cases). Those with serious response were managed by returning to supine position, thus driving up legs and intravenous atropine, CPR (2 cases with cardiac arrest) and needing oxygen supplementation (11 cases). Only 2 hypotension patients recovered gradually by 10 min after emergency management, while others recovered rapidly with no complications. Conclusion: Although non-invasive, TTT may result in serious response, especially in elderly. Therefore proper patient selection, control of isoproterenol infusion and close observation of vital signs are decisive for a safe consequence.

Key words: Tilt-table test (TTT), Vasovagal syncope (VVS), Serious response, Prophylactic management
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INTRODUCTION

Tilt-table test (TTT) has been widely accepted as one of the main measures for diagnosing vasovagal syncope (VVS), with 30%–90% positive rate and above 90% specificity (Ren *et al*., 1998). Although non-invasive, TTT may have risks, especially to the elders or in isoproterenol-provocative test. Even sudden deaths were reported in TTT by Grubb and Kosinski (1997). This article summarizes the serious responses in TTT.

OBJECTS AND METHODS

Objects

Seventy-six elderly patients (45 males and 31 females, aged 60 to 70 years) suffering from syncope were included in this study. The causes of syncope are still not determined. A thorough clinical investigation including electrocardiogram (ECG), 24-h Holter ambulatory monitoring and echocardiogram, to exclude neural origin diseases or carotid hypersensitivity was done. Before TTT, all patients were advised to stop taking anti-arrhythmia drugs, vas-active drugs and drugs which affect the autonomic nervous system for at least 5 half lives.

Methods

TTT was performed following a 6-h fast. And intravenous duct was inserted into each patient. The patients remained in a supine position for 15 min. Heart rate and ECG were monitored continuously and recorded on magnetic tape. Blood pressure was re-

corded every 5 min. The test was conducted in a commodious room with temperature of 25–30 °C and low lighting. The patients' torsos were belted tightly to prevent tumbling and then tilted to 70 degrees angle within 10 s. The end points of the test were: (1) Positive reaction: including occurrence of syncope or pre-syncope with heart rate slower than 50 beats/min, and/or blood pressure lower than 80/50 mmHg; (2) The patients had severe discomfort and could not tolerate the test; (3) The basic test had been taken for 45 min and multistage isoproterenol TTT had been taken for 30 min; (4) The heart rate exceeded 140 beats/min for over ten min during multistage isoproterenol TTT, or frequent ventricular premature beats resulting in paroxysmal ventricular tachycardia. Syncope is defined as transient loss of consciousness and inability to maintain postural tone. Pre-syncope is defined as paleness, sweat, dyspnea, hyperventilation, then followed by amaurosis, hypoacusis, nonresponsiveness, unsteadiness, etc.

RESULTS

All 76 elderly patients suffered from syncope more than once a week, with the longest syncope history of 38 years. All were unconscious for no more than 3 min when syncope occurs. About two thirds of the patients had prodromes such as belly discomfort, bellyache, dyspnea, etc. All 76 patients had no severe viscera diseases, although 2 had high serum cholesterol, 6 had carotid arteriosclerosis, 8 had bradycardia (2 of them had II°-I A-V block), 2 had chronic hypertension, 1 had chronic atria fibrillation, 1 had diabetes. Fifty-one of the 76 patients had positive reaction during TTT (67.11%); among them, 18 showed cardiac inhibitory response, 24 showed vasodepressor response and 9 showed mixed response; Twenty-three had serious response including: (1) severe bradycardia with heart rate slower than 50 min^{-1}, needing longer time (>1 min) to resumption (>50 min^{-1}); (2) cardiac arrest for more than 5 s; (3) serious hypotension (<80/50 mmHg) for more than 1 min. Serious responses consisted of mostly the following:

1. Six showed serious sinus bradycardia and sinus-atria block. Among them, 4 patients with carotid arteriosclerosis became symptomatic during basic TTT while 1 was symptomatic when isoproterenol (1 μg/min) was injected for 8 min. Their baseline cardiac rates were 60 to 70 min^{-1} and the fastest rate was less than 120 min^{-1}. Dyspnea was the main symptom before syncope, after which heart rate soon fell to 40 min^{-1} but which returned to 50 min^{-1} more than 1 min later.

2. Nine showed ventricular pause induced by complete atria-ventricular block. Among them, 5 had bradycardia (1 of them had II°-I A-V block and diabetes), 1 had chronic atria fibrillation. All 9 patients were asymptomatic before syncope but suddenly showed a slowdown of heart rate within several seconds, followed by atria-ventricular block and ventricular pause for more than 5 s with eyeball rolling up and tonic spasm. These were managed with chest compression (6 cases), oxygen and atropine administration (5 cases). The 9 patients immediately resumed consciousness and atria-ventricular conductibility with long intermission and frequent nausea for several minutes.

3. Eight showed serious hypotension. Among them, 2 had hypotension, 1 had bradycardia and carotid arteriosclerosis. During TTT, 4 had serious response such as weak pulse and sweating, then recovered after oxygen was given and atropine was injected for 10 min. For example:

A male patient, aged 76, suffering from syncope for 15 years, was diagnosed as "sick sinus syndrome" because of repeating syncope for 3 months. His average heart rate was 57 min^{-1} by Holter monitoring and the highest rate was 92 min^{-1}, the lowest was 39 min^{-1} with contingently II°-I A-V block. Left carotid arteriosclerosis appeared in the echocardiogram.

Before TTT, his baseline heart rate and blood pressure were 54 min^{-1} and 112/76 mmHg. When tilted, the heart rate was 71 min^{-1} and blood pressure was 100/68 mmHg. While tilted for 17 min, the patient experienced light-headedness followed by a fainting spell and numbness with heat rate 90 min^{-1} and a drop of blood pressure to 94/62 mmHg. Subsequently heart rate dropped to 48 min^{-1}; simultaneously the patient showed pale pallor, with eyeball rolling-up and no detectable blood pressure. The patient was immediately turned to supine position, blood pressure turned to 76/50 mmHg. And when immediately given oxygen, his legs were raised and

atropine was injected into him, the patient recovered consciousness 1 min later but still had obvious dyspnea, nausea and sweating; 3 min later, his heart rate was 66 min^{-1} and blood pressure was 78/53 mmHg. Blood pressure returned to normal range 10 min after high osmotic sugar was infused and liquid was administered.

DISCUSSION

VVS is a common type of syncope encountered clinically, and can occur repeatedly. It is characterized by an exaggerated sympathetic nervous response followed by excessive stimulation of the pneumogastric nerve, thus resulting in blood pressure drop, bradycardia and even ventricle pause. Because most VVS patients have no organic cardiovascular system diseases, they do not have symptoms at the usual time but are hypersensitive to autonomic nervous system stimulus. At present, TTT is extensively used to diagnose VVS in clinic, but as testees mostly have no organic cardiovascular disease so there are few reports about serious response of TTT (Li *et al*., 1994).

Before TTT, all the 76 elderly syncope patients had been strictly chosen and tested according to standard eligibility criteria. We eliminated those who had serious syndromes such as obvious coronary artery arteriosclerosis, cerebrovascular insufficiency and those who had higher than baseline blood pressures. We should carefully manage TTT in elderly patients because of their high incidence of cardiovascular diseases, weak organism enginery, weak parasympathetic system adjustment and balance power. In this report, 23 cases had serious TTT response (30.26%). Besides age, high serious response incidence is probably related to the following factors: (1) Primary cardiovascular disease such as hypertension, carotid arteriosclerosis, etc.; (2) Lower than baseline heart rate with sporadic sinus-atria or atria-ventricular block; (3) Diabetes; (4) Obvious pre-syncope aura symptoms such as dyspnea, nausea or unresponsiveness but the tilt bed was not rapidly returned to supine position when these happened; (5) During isoproterenol-provocative tilt testing, isoproterenol injection was not stopped when heart rate suddenly increased to 130% of baseline rate.

VVS patients suffering from syncope are usually tense and their dread of the tests may aggravate the response in TTT; so we should eliminate their anxiety first (Ge *et al*., 2000). Simultaneously, proper patients selection is essential to a safe consequence; sufficient preparation must be done before TTT, especially in those who had cardiovascular diseases. When nausea or dizziness occurs, heart rate must be monitored and blood pressure must be continuously managed. Once heart rate rapidly drops 50% or long intermission happens, the tilt bed must be quickly returned to supine position. Most elderly patients are insensitive to isoproterenol infusion, so isoproterenol hand-injection is banned when its dose is added by tiny pump. To those who are hypersensitive to isoproterenol, when infusion begins, their heart rate may exceed 50% of basic rate; at this time, isoproterenol infusion must be stopped and the bed should not be tilted again until the heart rate returns to 120% of baseline rate. In summary, proper patient selection, control of isoproterenol infusion and vigilant observation of vital signs are crucial for avoiding unwanted serious response in TTT.

References

Ge, W., Lu, L.J., Jiang, W.L., Han, Y., Chen, T.Z., 2000. The prevention and nursing of severe reaction during the straight and slope test. *Journal of Nurses Training*, **15**(2):135-136 (in Chinese with English abstract).

Grubb, B.P., Kosinski, D., 1997. Neurocardiogenic syncope and related syndromes of orthostatic intolerance. *Cardiology in Review*, **5**:182-189.

Li, Y.F., Hu, D.Y., Yang, M., Yang, L., Wang, J.N., 1994. Methodology evaluation of tilt table test diagnosis syncope. *Chinese Cardiovascular Disease Journal*, **22**:181 (in Chinese).

Ren, Z.W., Wu, N., Chen, M.Y., Li, J.C., Hu, D.Y., Guo, L.N., Huang, C.X., Huang, D.J., Jiang, W.P., 1998. Suggestion of tilt table test for diagnosis of vasovagal syncope. *Chin J Cardio*, **26**(5):325-327 (in Chinese).